Claim Amendments

1. (currently amended) A method, a sensor array that employs a parameter to induce a time-varying phase angle φ on an optical signal that comprises a phase generated carrier with a demodulation phase offset β, the method comprising the step of:

calculating the phase angle φ substantially independently of the demodulation phase offset β.

2. (currently amended) The method of claim 1, further comprising the step of:

sampling an output signal from the sensor array to obtain a plurality of samples S_n, wherein n = 0 to x;

wherein the step of calculating the phase angle φ substantially independently of the demodulation phase offset β comprises the step of:

calculating the phase angle φ substantially independently of the demodulation phase offset β through employment of one or more of the plurality of samples S_n.

3. (currently amended) The method of claim ~~1~~ 2, wherein the step of calculating the phase angle φ substantially independently of the demodulation phase offset β through employment of the one or more of the plurality of samples S_n comprises the steps of:

calculating one or more quadrature terms and one or more in-phase terms through employment of one or more of the plurality of samples S_n, wherein one or more of the one or more quadrature terms and one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β; and

calculating the phase angle φ through employment of the one or more quadrature terms and the one or more in-phase terms.

4. (original) The method of claim 2, wherein the output signal comprises a period T_{pulse}, wherein the step of sampling the output signal from the sensor array to obtain the plurality of samples S_n, wherein n = 0 to x comprises the step of:

sampling the output signal from the sensor array to obtain a plurality of samples S_n within a period T_s, wherein n = 0 to x, wherein T_s is less than or equal to $1.125 \times T_{pulse}$.

5. (original) The method of claim 4, wherein T_s is less than or equal to T_{pulse}.

6. (currently amended) The method of claim 4, wherein the step of calculating the phase angle φ <u>substantially</u> independently of the demodulation phase offset β through employment of the one or more of the plurality of samples S_n comprises the steps of:

calculating one or more quadrature terms and one or more in-phase terms through employment of one or more of the plurality of samples S_n, wherein one or more of the one or more quadrature terms and one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β;

calculating the phase angle φ through employment of the one or more quadrature terms and the one or more in-phase terms.

7. (original) The method of claim 6, wherein the step of calculating the one or more quadrature terms and the one or more in-phase terms through employment of the one or more of the plurality of samples S_n, wherein the one or more of the one or more quadrature terms and the one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β comprises the steps of:

calculating a set of quadrature terms Q_j and a set of in-phase terms I_k through employment of one or more of the plurality of samples S_n, wherein $j = 0$ to y, wherein $k = 0$ to z;

calculating a quadrature term Q_{ab} from a largest term of absolute values of the set of quadrature terms Q_j;

calculating a constant C_1 and a constant C_2;

calculating a quadrature term $Q_s = C_1 \times \sqrt{\sum_{j=0}^{j=y} Q_j^2}$, wherein Q_s is substantially independent from the demodulation phase offset β; and

calculating an in-phase term $I_s = C_2 \times \sqrt{\sum_{k=0}^{k=z} I_k^2}$, wherein I_s is substantially independent from the demodulation phase offset β.

8. (original) The method of claim 7, wherein the step of calculating the constant C_1 and the constant C_2 comprises the step of:

calculating the constant C_1 and the constant C_2 such that an amplitude of the quadrature term Q_s, an amplitude of the quadrature term Q_{ab}, and an amplitude of the in-phase term I_s comprise a substantially same amplitude for a modulation depth M of an operating range for the phase generated carrier.

9. (original) The method of claim 7, wherein $x = 7$, $y = 3$, $z = 1$, wherein the step of calculating the set of quadrature terms Q_j and the set of in-phase terms I_k through employment of the one or more of the plurality of samples S_n, wherein $j = 0$ to y, wherein $k = 0$ to z comprises the steps of:

calculating $Q_0 = S_0 - S_4$;

calculating $Q_1 = S_1 - S_5$;

calculating $Q_2 = S_2 - S_6$;

calculating $Q_3 = S_3 - S_7$;

calculating $I_0 = (S_0 + S_4) - (S_2 + S_6)$; and

calculating $I_1 = (S_1 + S_5) - (S_3 + S_7)$.

10. (original) The method of claim 7, wherein $x = 15$, $y = 7$, $z = 3$, wherein the step of calculating the set of quadrature terms Q_j and the set of in-phase terms I_k through employment of the one or more of the plurality of samples S_n, wherein $j = 0$ to y, wherein $k = 0$ to z comprises the steps of:

calculating $Q_0 = S_0 - S_8$;

calculating $Q_1 = S_1 - S_9$;

calculating $Q_2 = S_2 - S_{10}$;

calculating $Q_3 = S_3 - S_{11}$;

calculating $Q_4 = S_4 - S_{12}$;

calculating $Q_5 = S_5 - S_{13}$;

calculating $Q_6 = S_6 - S_{14}$;

calculating $Q_7 = S_7 - S_{15}$;

calculating $I_0 = (S_0 + S_8) - (S_4 + S_{12})$;

calculating $I_1 = (S_1 + S_9) - (S_5 + S_{13})$;

calculating $I_0 = (S_2 + S_{10}) - (S_6 + S_{14})$; and

calculating $I_1 = (S_3 + S_{11}) - (S_7 + S_{15})$.

11. (original) The method of claim 7, wherein the step of calculating the phase angle φ through employment of the one or more quadrature terms and the one or more in-phase terms comprises the steps of:

calculating a correction term ΔQ;

calculating a quadrature term Q_m from the quadrature term Q_s and the correction term ΔQ;

calculating a quadrature term Q from a magnitude of the quadrature term Q_m and one or more quadrature terms of the set of quadrature terms Q_j;

calculating an in-phase term I from a magnitude of the in-phase term I_s and one or more in-phase terms of the set of in-phase terms I_k; and

calculating the phase angle φ from an arctangent of a quantity Q / I.

12. (original) The method of claim 11, wherein the step of calculating the correction term ΔQ comprises the step of:

calculating the correction term $\Delta Q = Q_s - Q_{ab}$.

13. (currently amended) The method of claim 11, wherein the step of calculating the quadrature term Q_m from the quadrature <u>term</u> ~~terms~~ Q_s and <u>the correction term</u> ΔQ comprises the step of:

calculating a constant C_3; and

calculating $Q_m = Q_s + (C_3 \times \Delta Q)$.

14. (currently amended) An apparatus, a sensor array that employs a parameter to induce a time-varying phase angle φ on an optical signal that comprises a phase generated carrier with a demodulation phase offset β, the apparatus comprising:

a processor component that calculates the phase angle φ substantially independent from the demodulation phase offset β.

15. (currently amended) The apparatus of claim 14, wherein the processor component obtains a plurality of samples S_n of an output signal from the sensor array, wherein n = 0 to x;

wherein the processor component employs one or more of the plurality of samples S_n to calculate the phase angle φ substantially independent from the demodulation phase offset β.

16. (original) The apparatus of claim 15, wherein the processor component employs one or more of the plurality of samples S_n of the output signal to calculate one or more quadrature terms and one or more in-phase terms, wherein one or more of the one or more quadrature terms and one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β of the phase generated carrier;

wherein the processor component employs the one or more quadrature terms and the one or more in-phase terms to calculate the phase angle φ.

17. (original) The apparatus of claim 15, wherein the output signal comprises a period T_{pulse}, wherein the processor component obtains the plurality of samples S_n within a period T_8, wherein T_8 is less than or equal to $1.125 \times T_{pulse}$.

18. (original) The apparatus of claim 17, wherein T_s is less than or equal to T_{pulse}.

19. (original) The apparatus of claim 17, wherein the processor component employs one or more of the plurality of samples S_n of the output signal to calculate one or more quadrature terms and one or more in-phase terms, wherein one or more of the one or more quadrature terms and one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β of the phase generated carrier;

wherein the processor component employs the one or more quadrature terms and the one or more in-phase terms to calculate the phase angle φ.

20. (original) The apparatus of claim 19, wherein the one or more of the one or more quadrature terms comprise a quadrature term Q_{ab} and a quadrature term Q_6, wherein the one or more of the one or more in-phase terms comprise an in-phase term I_s;

wherein the processor component employs one or more of the plurality of samples S_n, the quadrature term Q_{ab}, the quadrature term Q_6, and the in-phase term I_s to calculate the phase angle φ.

21. (original) The apparatus of claim 20, wherein the processor component employs the plurality of samples S_n to calculate a set of quadrature terms Q_j and a set of in-phase terms I_k, wherein j = 0 to y, wherein k = 0 to z;

wherein the processor component employs the set of quadrature terms Q_j to calculate the quadrature term $Q_{ab} = \max(|Q_j|)$, wherein j = 0 to y;

wherein the processor component employs the set of quadrature terms Q_j and the set of in-phase terms I_k to calculate the quadrature term Q_6, and the in-phase term I_6.

22. (original) The apparatus of claim 21, wherein the processor component calculates a constant C_1 and a constant C_2, wherein the processor component calculates:

$$Q_s = C_1 \times \sqrt{\sum_{j=0}^{j=y} Q_j^2};$$

wherein the processor component calculates:

$$I_s = C_2 \times \sqrt{\sum_{k=0}^{k=z} I_k^2};$$

wherein the processor component calculates the constant C_1 and the constant C_2 such that a magnitude of the quadrature term Q_s, a magnitude of the quadrature term Q_{ab}, and a magnitude of the in-phase term I_s comprise a substantially same magnitude at a modulation depth M of an operating range for the phase generated carrier.

23. (original) The apparatus of claim 22, wherein the processor component employs the quadrature term Q_{ab} and the quadrature term Q_s to calculate a correction term $\Delta Q = Q_s - Q_{ab}$;

wherein the processor component employs the quadrature term Q_s and the correction term ΔQ to calculate a quadrature term Q_m;

wherein the processor component employs the quadrature term Q_m, the in-phase term I_s, the set of quadrature terms Q_j, and the set of in-phase terms I_k to calculate the phase angle φ.

24. (original) The apparatus of claim 23, wherein the processor component employs the quadrature term Q_m and the set of quadrature terms Q_j to calculate a quadrature term Q, wherein the processor component employs the in-phase term I_s and the set of in-phase terms I_k to calculate an in-phase term I;

wherein the processor component calculates:

$Q = \pm Q_m$;

wherein the processor component calculates:

$I = \pm I_s$;

wherein the processor component employs the set of quadrature terms Q_j to determine a sign of Q;

wherein the processor component employs the set of in-phase terms I_k to determine a sign of I;

wherein the processor component calculates:

$\varphi = \text{arctangent}\,(Q / I)$.

25. (original) The apparatus of claim 24, wherein the processor component calculates a constant C_3, wherein the processor component calculates:

$$Q_m = Q_s + (C_3 \times \Delta Q).$$

26. (original) The apparatus of claim 25, wherein $x = 7$, $y = 3$, and $z = 1$;

wherein the processor component calculates:

$Q_0 = S_0 - S_4$, $Q_1 = S_1 - S_5$, $Q_2 = S_2 - S_6$, and $Q_3 = S_3 - S_7$;

wherein the processor component calculates:

$I_0 = (S_0 + S_4) - (S_2 + S_6)$; and

$I_1 = (S_1 + S_5) - (S_3 + S_7)$.

27. (original) The apparatus of claim 25, wherein $x = 15$, $y = 7$, and $z = 3$;

wherein the processor component calculates:

$Q_0 = S_0 - S_8$, $Q_1 = S_1 - S_9$, $Q_2 = S_2 - S_{10}$, $Q_3 = S_3 - S_{11}$,

$Q_4 = S_4 - S_{12}$, $Q_5 = S_5 - S_{13}$, $Q_6 = S_6 - S_{14}$, and $Q_7 = S_7 - S_{15}$;

wherein the processor component calculates:

$I_0 = (S_0 + S_8) - (S_4 + S_{12})$, $I_1 = (S_1 + S_9) - (S_5 + S_{13})$,

$I_2 = (S_2 + S_{10}) - (S_6 + S_{14})$, and $I_3 = (S_3 + S_{11}) - (S_7 + S_{15})$.

28. (currently amended) An article, a sensor array that employs a parameter to induce a time-varying phase angle φ on an optical signal that comprises a phase generated carrier with a demodulation phase offset β, the article comprising:

one or more computer-readable signal-bearing media;

means in the one or more media for calculating the phase angle φ substantially independently of the demodulation phase offset β.

29. (currently amended) The article of claim 28, further comprising:

means in the one or more media for sampling an output signal from the sensor array to obtain a plurality of samples S_n, wherein $n = 0$ to x;

wherein the means in the one or more media for calculating the phase angle φ substantially independently of the demodulation phase offset β comprises:

means in the one or more media for calculating the phase angle φ substantially independently of the demodulation phase offset β through employment of one or more of the plurality of samples S_n.

30. (currently amended) The article of claim 29, wherein the means in the one or more media for calculating the phase angle φ substantially independently of the demodulation phase offset β through employment of the one or more of the plurality of samples S_n comprises:

means in the one or more media for calculating one or more quadrature terms and one or more in-phase terms through employment of one or more of the plurality of samples S_n, wherein one or more of the one or more quadrature terms and one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β; and

means in the one or more media for calculating the phase angle φ through employment of the one or more quadrature terms and the one or more in-phase terms.

31. (original) The article of claim 29, wherein the output signal comprises a period T_{pulse}, wherein the means in the one or more media for sampling the output signal from the sensor array to obtain the plurality of samples S_n, wherein n = 0 to x comprises:

means in the one or more media for sampling the output signal from the sensor array to obtain the plurality of samples S_n within a period T_s, wherein n = 0 to x , wherein T_s is less than or equal to $1.125 \times T_{pulse}$.

32. (original) The article of claim 31, wherein T_s is less than or equal to T_{pulse}.

33. (currently amended) The article of claim 31, wherein the means in the one or more media for calculating the phase angle φ substantially independently of the demodulation phase offset β through employment of the one or more of the plurality of samples S_n comprises:

means in the one or more media for calculating one or more quadrature terms and one or more in-phase terms through employment of one or more of the plurality of samples S_n, wherein one or more of the one or more quadrature terms and one or more of the one or more in-phase terms are substantially independent from the demodulation phase offset β;

means in the one or more media for calculating the phase angle φ through employment of the one or more quadrature terms and the one or more in-phase terms.

34. (new) The article of claim 33, wherein the means in the one or more media for calculating the one or more quadrature terms and the one or more in-phase terms through employment of the one or more of the plurality of samples S_n comprises:

means in the one or more media for calculating a set of quadrature terms Q_j and a set of in-phase terms I_k through employment of one or more of the plurality of samples S_n, wherein j = 0 to y, wherein k = 0 to z;

means in the one or more media for calculating a quadrature term Q_{ab} from a largest term of absolute values of the set of quadrature terms Q_j;

means in the one or more media for calculating a constant C_1 and a constant C_2;

means in the one or more media for calculating a quadrature term $Q_s = C_1 \times \sqrt{\sum_{j=0}^{j=y} Q_j^2}$, wherein Q_s is substantially independent from the demodulation phase offset β; and

means in the one or more media for calculating an in-phase term $I_s = C_2 \times \sqrt{\sum_{k=0}^{k=z} I_k^2}$, wherein I_s is substantially independent from the demodulation phase offset β.

35. (new) The article of claim 34, wherein the means in the one or more media for calculating the constant C_1 and the constant C_2 comprises:

means in the one or more media for calculating the constant C_1 and the constant C_2 such that an amplitude of the quadrature term Q_s, an amplitude of the quadrature term Q_{ab}, and an amplitude of the in-phase term I_s comprise a substantially same amplitude for a modulation depth M of an operating range for the phase generated carrier.

36. (new) The article of claim 34, wherein the means in the one or more media for calculating the phase angle φ through employment of the one or more quadrature terms and the one or more in-phase terms comprises:

means in the one or more media for calculating a correction term ΔQ;

means in the one or more media for calculating a quadrature term Q_m from the quadrature term Q_s and the correction term ΔQ;

means in the one or more media for calculating a quadrature term Q from a magnitude of the quadrature term Q_m and one or more quadrature terms of the set of quadrature terms Q_j;

means in the one or more media for calculating an in-phase term I from a magnitude of the in-phase term I_s and one or more in-phase terms of the set of in-phase terms I_k; and

means in the one or more media for calculating the phase angle φ from an arctangent of a quantity Q / I.

37. (new) The article of claim 34, wherein the means in the one or more media for calculating the correction term ΔQ comprises:

means in the one or more media for calculating the correction term $\Delta Q = Q_s - Q_{ab}$;

wherein the means in the one or more media for calculating the quadrature term Q_m from the quadrature term Q_s and the correction term ΔQ comprises:

means in the one or more media for calculating a constant C_3; and

means in the one or more media for calculating $Q_m = Q_s + (C_3 \times \Delta Q)$.